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BY JOSEPH JACOBS.

REPORT OF N. E. L. A. ELECTRIC RANGE COMMITTEE.

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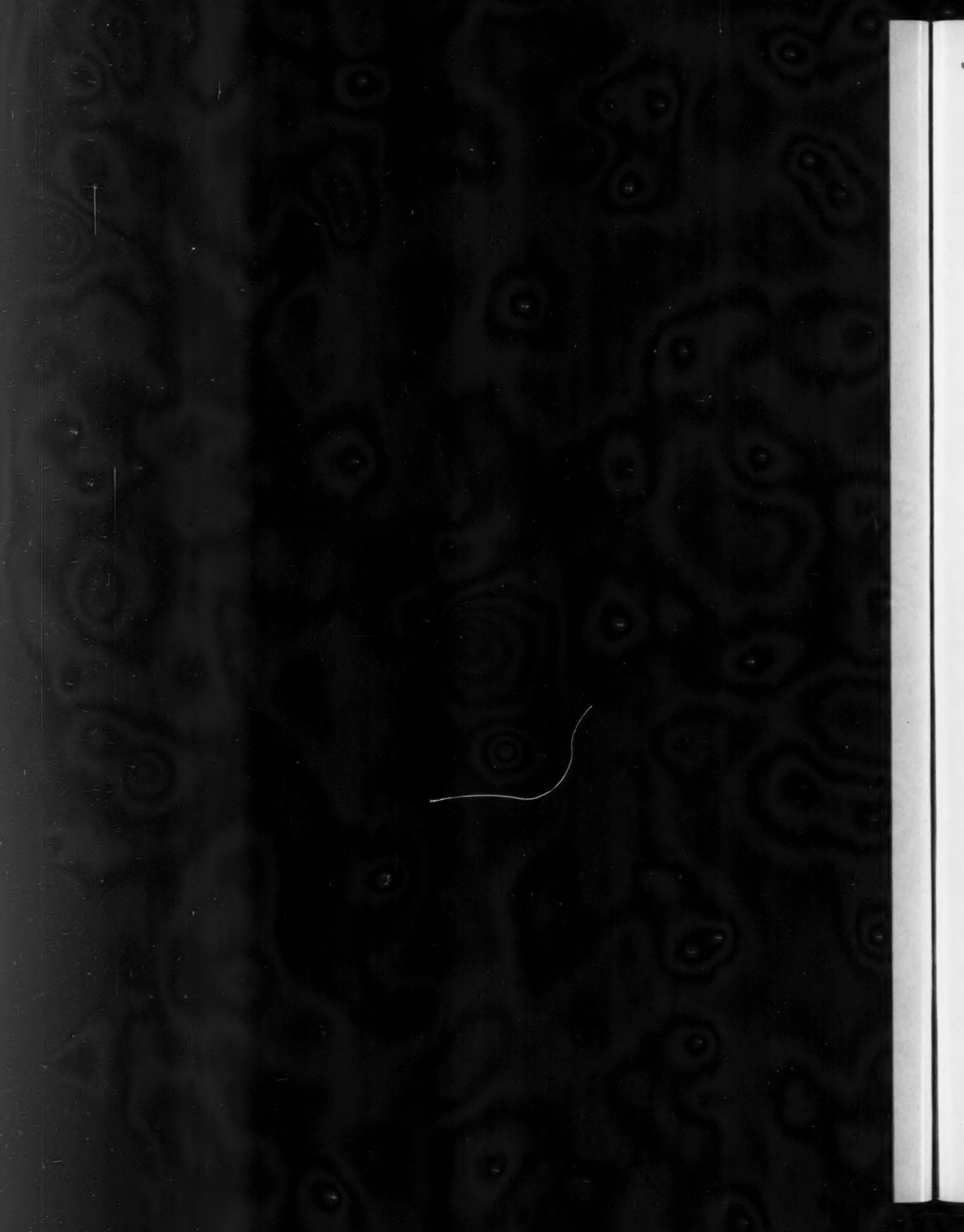

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PROGRESS ON SAN FRANSQUITO PLANT

LOS ANGELES AQUEDUCT POWER PROJECT

The first hydroelectric generating station in an ultimate development of 200,000 h.p. along the line of the Los Angeles aqueduct, is almost ready for operation. Situated near the head of San Fransquito Canyon, 47 miles from Los Angeles, Plant No. 1 utilizes water brought from the Owens River through 200 miles of aqueduct. Only a few finishing touches are necessary to materialize this dream of a decade to an actual reality.

Electric power is a by-product of the great aqueduct which has been supplying Los Angeles and vicinity with water for domestic and irrigation purposes during the past two years. In the 200 miles between the intake and Fairmont Reservoir is a difference in elevation of 3800 feet. This is sufficient not only to provide ample grade to allow of rapid flow of water, but also to allow its utilization for power purposes at several sites.

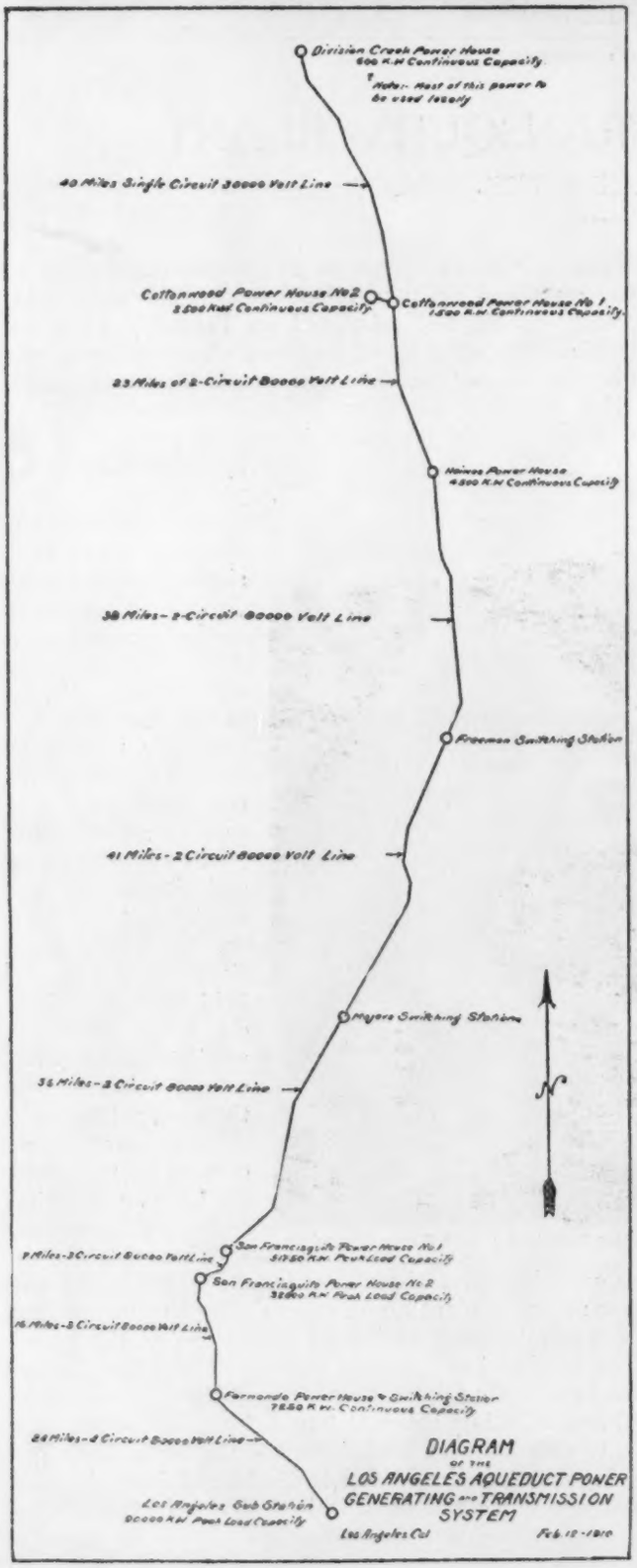
San Fransquito No. 1 Power Plant, showing Penstocks and Surge Chamber.

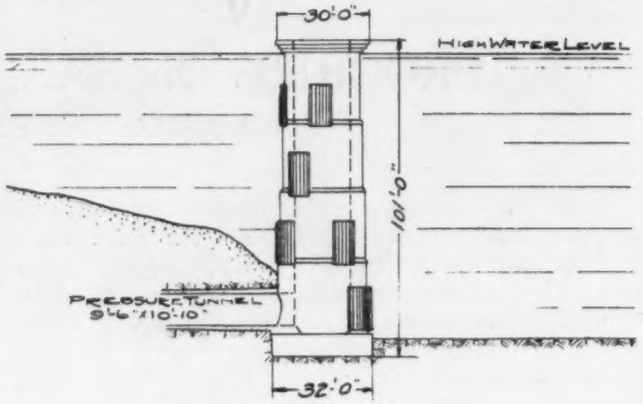
The most favorable of these and the first to be developed on a large scale is at the outlet of 26,500 ft. of tunnels leading from Fairmont Reservoir to the head of the San Fransquito Canyon. Here an effective head of 870 ft. has been utilized for an initial installation of 22,500 kw. in three generating units. This plant can be doubled in capacity by the installation of three similar units. However, in the judgment of the consulting board of engineers, consisting of W. F. Durand, O. H. Ensign and Harris J. Ryan, it was thought best to provide three units at the start and add the others as demand warranted. Their first report, submitted on February 12, 1910, outlined the plans which have since been followed under the immediate direction of E. F. Scattergood, chief electrical engineer, William Mulholland, chief engineer for the aqueduct, having supervision of the hydraulic features of the work.

The long interval that has elapsed since the determination to use aqueduct water for power generation and the completion of the project has been due primarily to lack of available funds. Several times work was suspended until bonds could be voted and their validity established. There was one period especially, from January 1914 until July 1915, during which no work could be prosecuted because of the enforced delay.

This power development may be said to begin at the Fairmont Reservoir, which acts not only as one of a series of storages for the water supply but also as power plant forebay, regulating the fluctuations of water to meet peak load conditions at the plant. This forebay has a storage capacity of 7620 acre ft. The conduit leading into the reservoir has a capacity of 20 sec. ft., while the outlet tunnel can carry 1000 sec. ft. to care for peak load demands, the mean discharge being 400 seec. ft. Water is discharged from the lake into the north end of Elizabeth Tunnel through an

Fairmont Reservoir.


Division Creek Power House
600 K.W. Continuous Capacity
40 Miles Single Circuit 30000 Volt Line
Cottonwood Power House No 2
2500 K.W. Continuous Capacity
Cottonwood Power House No 1
1500 K.W. Continuous Capacity
23 Miles of 2-Circuit 30000 Volt Line
Haiwee Power House
4500 K.W. Continuous Capacity
38 Miles - 2-Circuit 30000 Volt Line
Freeman Switching Station
41 Miles - 2 Circuit 30000 Volt Line
Myers Switching Station
36 Miles - 2 Circuit 30000 Volt Line
San Francisquito Power House No 1
51250 K.W. Peak Load Capacity
San Francisquito Power House No 2
32500 K.W. Peak Load Capacity
Sylmar Switching Station
7850 K.W. Continuous Capacity
24 Miles - 2 Circuit 30000 Volt Line
DIAGRAM
OF THE
LOS ANGELES AQUEDUCT POWER
GENERATING and TRANSMISSION
SYSTEM
Los Angeles Sub Station
90000 K.W. Peak Load Capacity
Los Angeles Cal
Feb. 12 - 1910

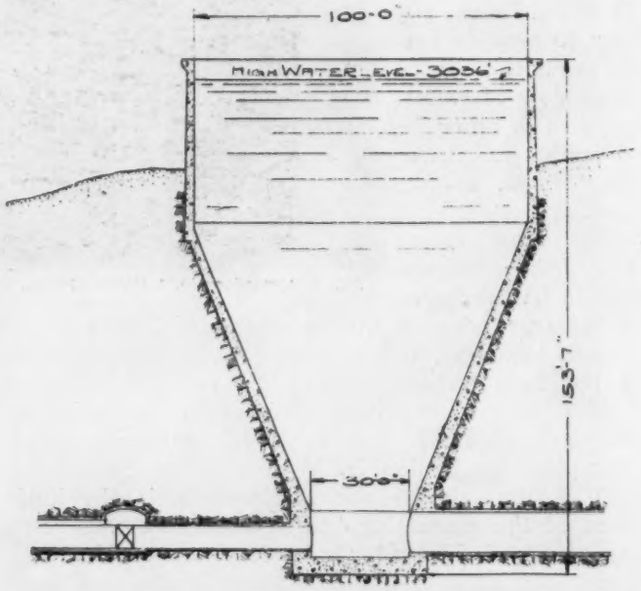


Intake Tower, Fairmont Reservoir.

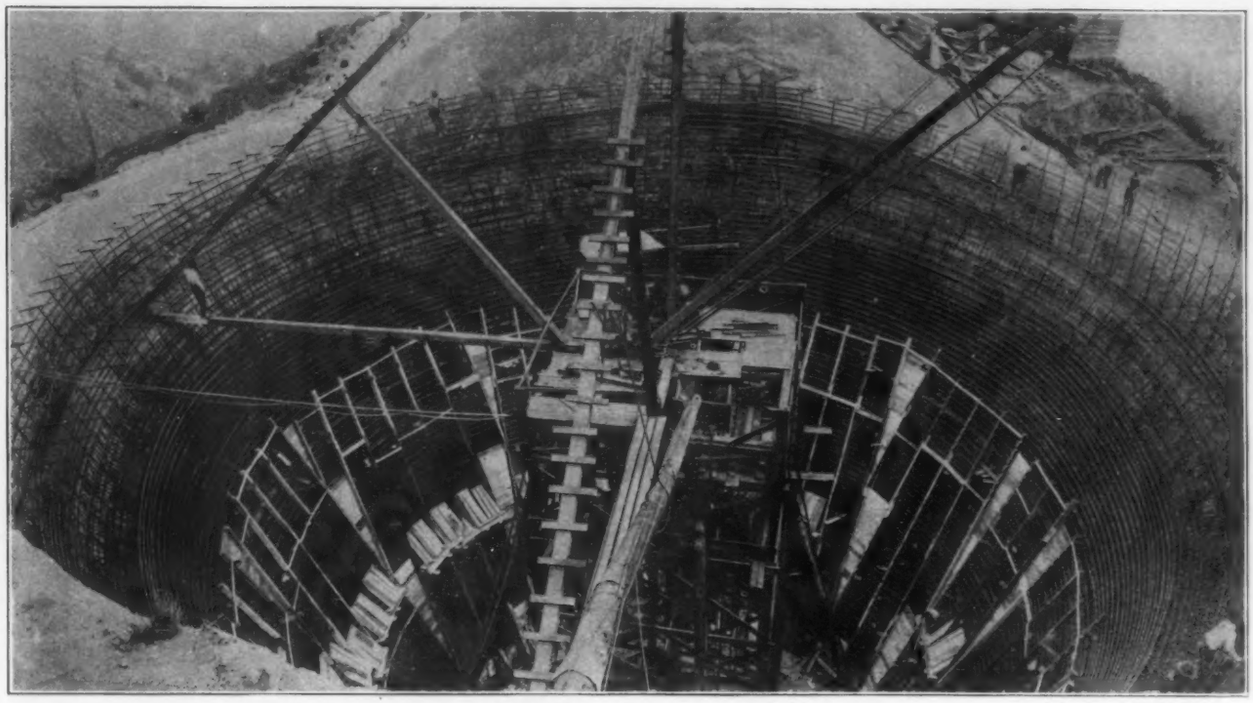
outlet tower and regulating gates, which can be seen in the accompanying illustration. The Elizabeth tunnel, in its 26,500 ft. length, drops 59 ft., and being lined throughout with concrete and being operated under pressure, acts as penstock.

At the south end of the tunnel and at the head of the pipe penstocks is a great surge chamber designed to prevent possible water hammer, pressure waves or sudden changes of head. This has been excavated in the mountain above the tunnel exit and has been lined with concrete so as to be watertight.

The penstock consists of two 7 ft. steel pipes dropping down the mountain side to the power plant. These are approximately 3600 ft. in length from the bottom of the surge chamber to the wheels of the



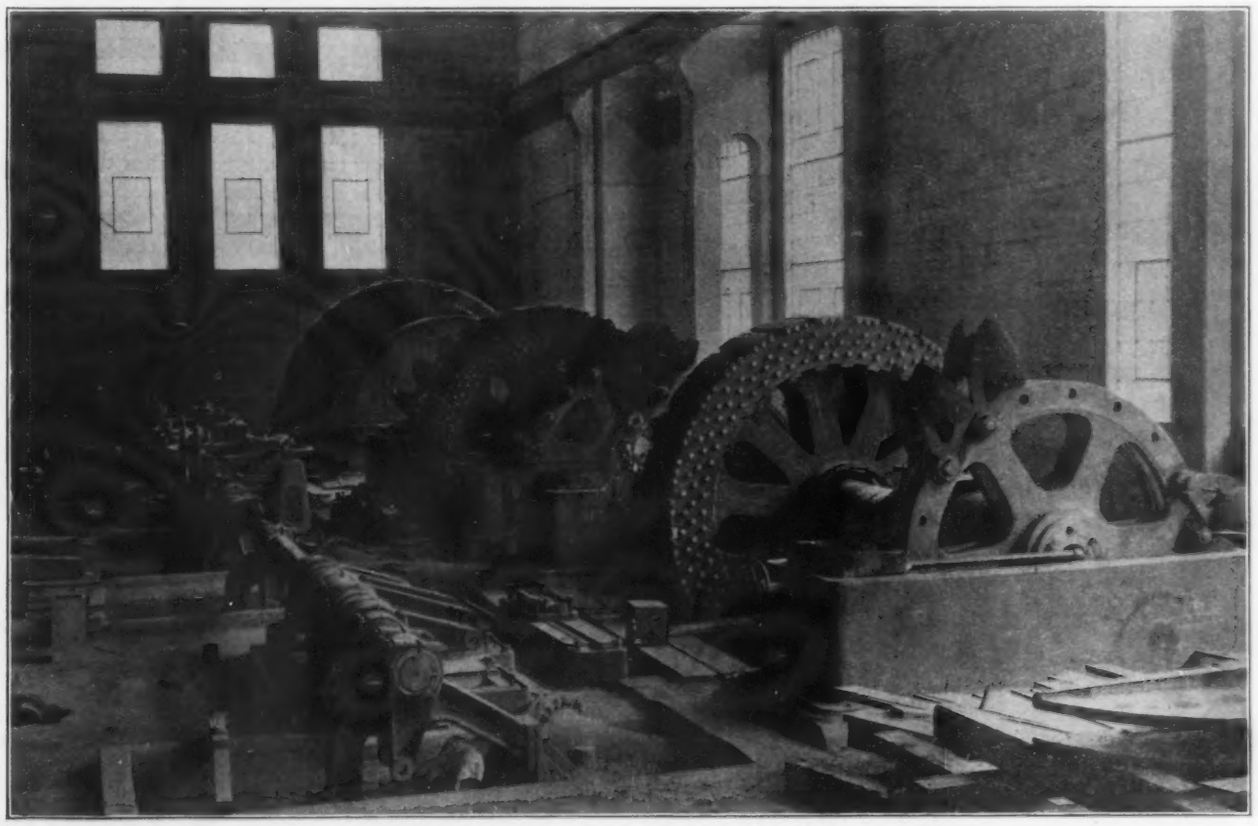
Sectional View of Surge Chamber.



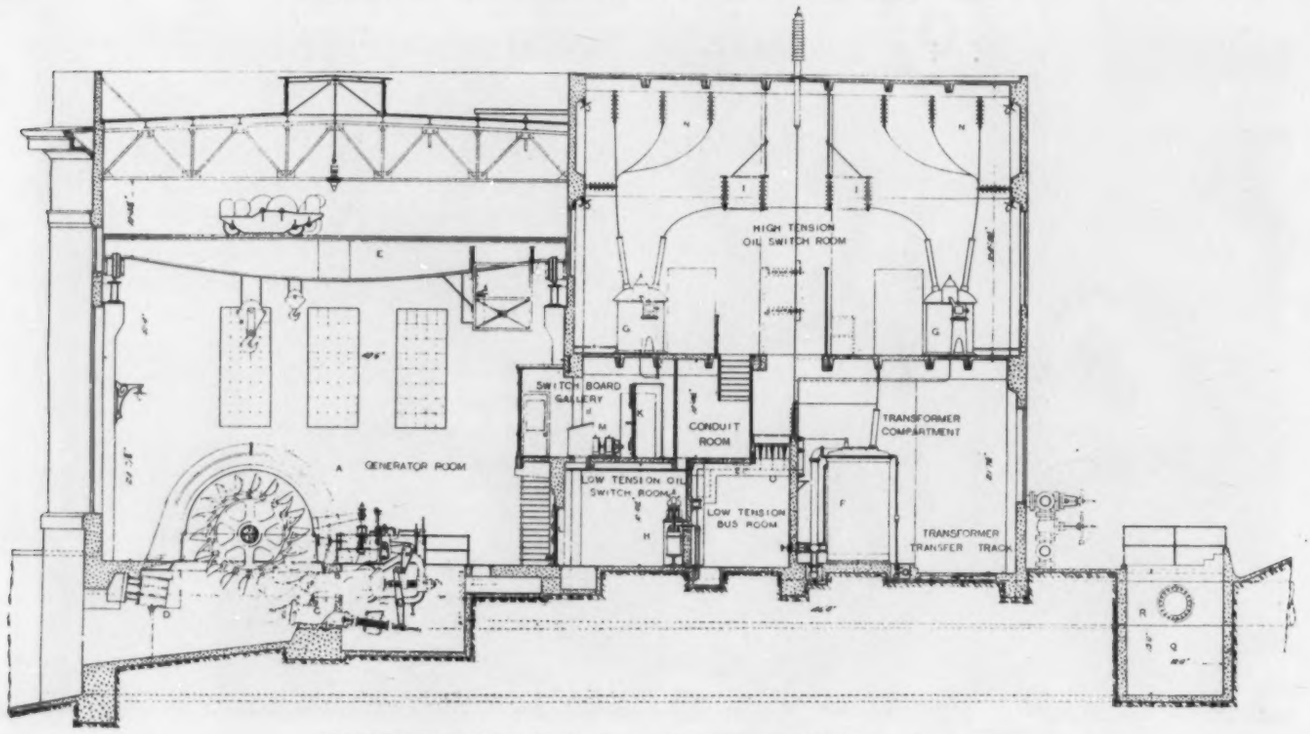
Surge Chamber Under Construction.

power house. They are designed for a maximum flow of 1000 sec. ft. and, consequently, the head on the penstock at the surge chamber will vary between 10 ft. and 138 ft. and the head on the power house will vary between 800 ft. and 940 ft. as the water flow varies from 1000 sec. ft. to zero. Ultimately there will be 3 penstocks leading from the surge chamber, each of which will branch into two penstocks at a point in the grade, from which point there will be six penstocks leading to the power house and connecting to 6 separate generator units.

The power house is a reinforced concrete structure, arranged so that its size can be doubled when necessary. It contains 3 generating units, each consisting of a 9375 k.v.a., 6600 volt, 3-phase, 50 cycle, generator driven by double overhung impulse water

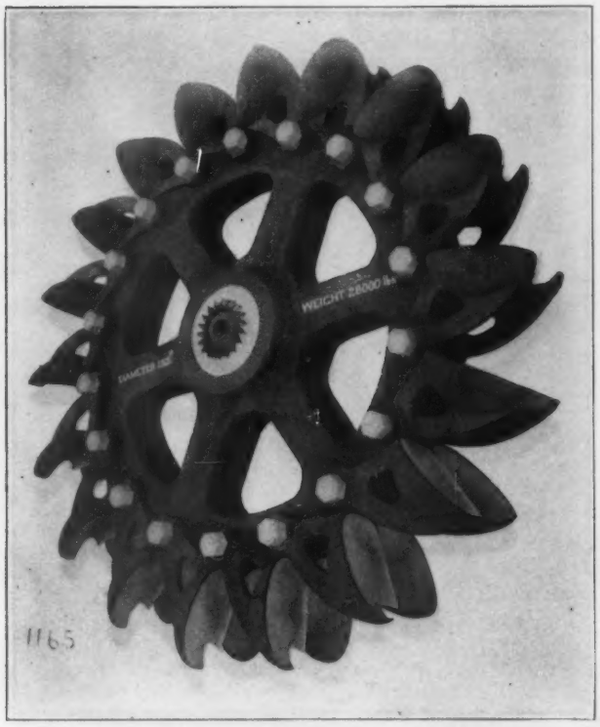


Generating Apparatus as Installed May 29, 1916.



Typical Cross Section of San Fransquito Power House No. 1.

A. 9375 k.v.a. Water Wheel Generator Unit.
B. Main Nozzle.
C. Safety and By-Pass Nozzle.
D. Vortex Baffle.
E. 50-Ton Crane.
F. 3150 k.v.a 110,000 Volt Transformer.
G. 110,000 Volt Oil Switch.
H. 6600 Volt Oil Switch.
I. 110,000 Volt Disconnecting Switch.
J. Control Desk.
K. Meter Panel.
L. Exciter Switch Board.
M. Motor Generator Set.
N. 110,000 Volt Bus.
O. 6600 Volt Tie Bus.
P. Exciter Penstocks.
Q. Discharge Pit Rod Safety and By-Pass Valves.
R. Welded Penstock.



Waterwheel Runner, Chain Type Construction.

wheels at 200 r.p.m. The generators were furnished by the Westinghouse Electric & Manufacturing Company.

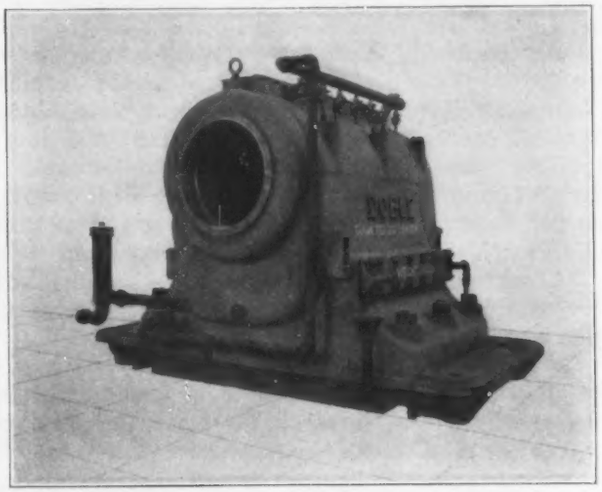
Exciting current is furnished by two 250 kw., 250 volt d.c. generators driven at 400 r.p.m. by single overhung impulse wheels. Current is transformed from 6600 volts delta to 61,000 volts Y for transmission 47 miles to the Los Angeles main substation, by means of 9 single-phase, 3150 k.v.a. transformers, shell type, oil insulated and water cooled, there being one spare unit.

The water wheels were furnished by the Doble Water Wheel Company of San Francisco, which has since been absorbed by the Pelton Water Wheel Company. The main units operate under an effective head of 845 ft. and are rated at 14,000 h.p. each. They are fitted with water-economizer needle-nozzles, and Ensign vortex baffle plates. The exciter wheels are 450 h.p. machines. The governors have Lombard heads with Doble actuating mechanism. There is also a central goveror oiling system of the closed type.

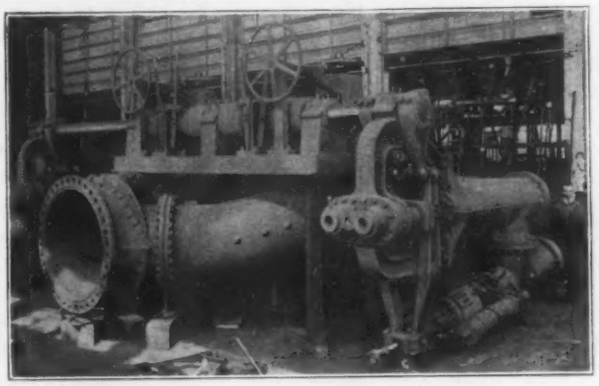
Transmission will be accomplished by means of two duplicate steel tower lines. The conductor is 300,000 cir. mil., 19 strand copper and the insulators are of the suspension type, consisting of seven 10 inch units.

The purpose of the present article is merely to show the present status of aqueduct power construction. Complete details as to costs and methods will be published later. At the present time the surge chamber has been finished. The power house is 95 per cent complete, including a 50-ton traveling crane. Transmission line towers are now being erected by gangs in the field. Excavation for the central receiving substation in Los Angeles is well under way, the foundations having been poured and work progressing rapidly. The machine shop, a two-story brick building,

is ready for occupancy. A substation has also been started at Garvanza, where over 4000 distributing poles varying in height from 35 ft. to 90 ft., have been erected. The East Los Angeles District has also been



Pedestal Bearing, with Sole Plate, Water Cooled Type.



Needle Nozzle Regulating Mechanism.

practically covered and as soon as poles are available work will be started in the Hollywood District. Bids are now being received for copper wiring and it is expected that this will be strung by the time that the plant is ready to turn over.

Iron conduit in concrete containing cinders, salt, sea water or other substance which has a corrosive action on piping, or if the concrete or cement in which the pipe is laid is to be exposed to brine, acid pickling bath liquor or other liquids of corrosive nature, or if the conduit is to be laid in contact with composition flooring, or similar structural material, should preferably be made up of pipe and fittings galvanized on the outside and should be painted with two coats of a pure red-lead paint, a bituminous paint or an equivalent protective covering. It is preferable that it also be wrapped or coated with an approved material for protection against corrosion.

Bare grounded return wiring systems are being investigated by a sub-committee of the general committee on electrical wiring systems, C. E. Corrigan of Pittsburgh being chairman. Information regarding experience with concentric wiring systems or ground connections is desired by the secretary, W. S. Boyd, 175 W. Jackson Blvd., Chicago.

ILLUMINATING ENGINEERING LECTURE COURSE.

BY G. H. STICKNEY.

Although many centuries have elapsed since artificial light was first produced, very little progress had been made toward effective lighting until the nineteenth century. The advance in the last decade has been incredibly great compared with any previous period. This remarkable acceleration has been due to two factors; the development of lighting units and the increased knowledge regarding their application. The latter being everybody's business was very liable to neglect. The Illuminating Engineering Society has been one of the most important factors in encouraging the determination and collection of such knowledge and facilitating its dissemination. The 1910 Lecture Course was the most notable event in the standardization of that knowledge. It logically gave its principal emphasis to the well determined principles of light production, distribution and utilization as scientific problems. Lighting practice as such was not sufficiently crystalized to permit of concrete and definite treatment. However, remarkable progress has been made in this direction during the past six years and the time is now ripe for a comprehensive inventory of lighting practice, based upon the excellent foundation laid in 1910.

The 1916 lectures at the University of Pennsylvania from September 21-28 will be of great value to those interested in the design of lighting installations, whether as purchasers, salesmen, engineers, constructors, physiologists or artists. Beyond the value rendered to those fortunate individuals who attend the course, there is a broader value which is bound to be realized, the same as in the 1910 course. The course will have a marked influence in advancing the art of illumination. Through its influence a better standard of lighting will be secured throughout the country. Inartistic and glaring light will be strenuously condemned and misconceptions rectified. The precious power of sight will be more carefully conserved.

Preliminary List of Lecture Subjects.

Subject.	No. of Lectures
(A) General	
(1) The Principles of Interior Illumination	2
(2) The Principles of Exterior Illumination	1
(3) Color in Lighting	1
(4) Architectural and Decorative Aspects of Lighting	1
(5) Recent Developments in Electric Lighting Appliances	1
(6) Recent Developments in Gas Lighting Appliances	1
(7) Modern Lighting Accessories	1
(B) Special Lectures on Interior Illumination	
(8) The Lighting of Factories, Mills and Workshops	1
(9) The Lighting of Offices, Stores and Show-Windows	1
(10) The Lighting of Schools, Auditorium and Libraries	1
(11) The Lighting of Churches	1
(12) Theatre Lighting (including Stage Lighting) and the Lighting of Art Museums	1
(13) The Lighting of the Home	1
(14) Train Lighting	1
(C) Special Lectures on Exterior Illumination	
(15) Street Lighting	2
(16) The Lighting of Yards, Docks and Other Outside Works	1
(17) Headlights, Searchlights and Projectors	1
(18) Sign Lighting	1
(19) Building Exterior, Exposition and Pageant Lighting	1

OUT OF DOOR HYDROELECTRIC PLANTS.

BY RALPH BENNETT.

(Detailed analysis is here presented of the slight changes in design of apparatus which would make it possible to dispense with power-houses as a protection for electrical apparatus. This paper was presented at the January meeting of the Los Angeles Section of the American Institute of Electrical Engineers. The author is a consulting engineer at Los Angeles.—The Editor.)

The rapid development of rugged types of transformers, of enclosed generators, of reliable insulators and the growth of the size of the units in the plants are all conditions favoring the elimination of much of the elaborate protection from weather which was necessary with the early apparatus.

The actual attention required by modern apparatus is slight. The labor expended in keeping blank cast iron surfaces wiped up, in sweeping and dusting the vast floors and wall surfaces, and in maintaining the roofs, windows and incidental apparatus is enormously greater than that actually expended on portions of the building actually essential to the active generation of energy.

A brief resume of the status of the art with particular reference to the possible use of complete out of door hydroelectric generating stations is of interest.

Transformers and Switches.

At receiving stations and at substations the use of out of door types of transformers and oil switches has already been developed into well accepted practice. Arrangements of high tension open air bus-bars of sufficient variety to meet any diagram of connections desired are already in use. The various types of suspension insulator have proven reliable and convenient. The initial cost of the tower structures and of the wiring compare favorably with enclosed bus-bar costs and the work is fully as safe.

The only serious problem on the transformers and switches was the high tension terminals. The more liberally designed types have proven as successful in the open as the indoor types.

The total space required is usually increased in such stations over that required for the indoor high tension work, but not to a serious extent. Provision for taking apparatus apart is usually made by building a small enclosed shop to which the injured unit can be wheeled. As but one crew can often be worked on the repairs such a single repair point rarely delays the repair work while it keeps the oil and repair parts well concentrated. Good practice provides this shop with a pit into which the transformer case can be lowered so that the coils are exposed at about the floor level.

This class of apparatus can receive but little detail attention while in service. Cooling water for the transformers can be led to any convenient point for observation. Leakage of oil can be observed, and leakage of electricity can sometimes be heard before a final breakdown. Cleaning of the exterior surfaces of the cases is of no particular value. Cleaning of porcelain or other creepage surfaces of "dead" transformers or switches can be the more easily accomplished the more open the surroundings. Knife blade disconnecting switches can better be set in the open with ample spacing than between confining walls to which an arc can form.

Generators.

Open type generators taking air from, and returning it to, the room require a dry, well ventilated power-house. They become dusty and must be blown out rather frequently. Open slip rings need protection and can be oiled from time to time to advantage.

Fully enclosed generators have come into general use in connection with high speed steam turbines. These units, including the rings, are completely boxed in with a cast iron case and take air from, and deliver it to, the outer air. They can receive no attention of merit while in service. If the incoming air is properly purified by screens and baffles, the dust and moisture which reach the winding are nominal in amount.

These generators have proven to be reliable in service and to be distinctly advantageous from the operating standpoint. Not only is the attendance reduced to external wiping and the watching of bearings, but the reduction of generator noise and the absence of excess heat from the machines render the generator room more comfortable.

Observation of internal iron temperatures, and even of the condition of the windings, is possible by means of thermostat windings placed in the interior of the machine during assembly. These may be, if desired, made to record, thus giving a permanent record of the usage to which the unit has been subjected.

There is no particular reason why this class of unit should not be operated in the open. Slight changes in the joining of the case, in the air connections and in the slip rings and shaft arrangements are all that would be necessary by the omission of all cover.

Exciters.

The demand for excitation and other direct current energy in a large, modern power plant calls for exciter units of considerable size. The water wheels driving them are of the same general type as are the main wheels and with their governors can be treated as are the larger units.

The exciters are now generally 250 volt continuous current interpole machines. They require no special attention and have so little commutator trouble that special accessibility is no longer as necessary as was the case a few years since. If completely enclosed and operated in the open they will still be subject to less severe conditions than are large enclosed mill and railway motors.

As their current flows are large the use of remote control main and field switches throughout is desirable. With such switches the location of the exciters near the main board is not a matter of importance as the only considerable advantage with a completely enclosed exciter would be short runs for the main leads to the board. Any location which suits the general layout of the plant will now be suitable.

Bearings.

A few years ago the only type of bearing in successful use required constant drip supply of oil. The modern motors are supplied with ring oiling bearing which go for many months without attention. Heavy generators have oil or water circulation which keeps them at any predetermined temperature. The piping from these coils can be led, as can the transformer cooling lines, to any selected observation point. If

desired the placing of thermostats or recording thermometers in these bearings can be easily arranged. As the bearing is of its necessary construction waterproof, it can as well be in the open as under a roof.

Governor.

About the only delicate and accurately adjusted piece of apparatus left in the modern power plant is the governor head. As now designed a water wheel governor consists of a plunger or plungers connected by link rods and bell cranks to the water control devices and a set of flyball controlled admission valves called the governor head. The form of the plunger system and the size of the cylinders in which the oil pressure is applied vary with the type of water control.

A common impulse wheel system has been the deflecting nozzle with a slow or hand operated needle. Of recent years the use of a set of two duplicate nozzles, one playing on the wheel and one wasting water, has been extensively introduced. Slow needles driven from the governor are used if water saving is desired.

Turbine control has almost completely narrowed down the use of heavy gate rings operating movable admission vanes. If a bypass is required it may be controlled from the governor or by the pressure rise in the pipe or from both sources.

But in any case the function of the plunger system is reduced to a simple firm stroke of a time and length predetermined by the governor head.

This head consists of a series of interacting parts applying their forces on a pilot valve which controls the main cylinder. Part of the interacting forces are a function of the speed derived from the flyballs driven from the unit. Part is an optional control by the station operator at the switchboard. Part is a provision against overrunning and part a provision against overrapid action. These two are usually derived from mechanical connections to the governed mechanism.

As at present developed this head must be open for observation and readjustment to varying load conditions. But practice does not demand that it be placed directly upon the control cylinders. In fact it is rarely possible to so place it even though the designer wish the more accurate action which short pipes and rods are supposed to give. In large plants the separation is frequently 25 to 50 ft.

Doubtless this governor head should be housed and in a position from which the switchboard or central control position can be readily communicated with. Indicating dials showing the complete position of all parts of the governor head and of the cylinder system can be placed on the main control board.

Valves.

Modern gate valves may be placed at any convenient place and controlled by electric circuits from the main control board. There are no parts liable to get out of order which daily attention will help. The placing of proper watertight covers over the electric devices or of insulating jackets around hydraulic cylinders is necessary in open air installations, but has already become well developed.

Control Board.

In a thoroughly modern plant all the control, both electrical and mechanical, is centered in the main control center. Here are meters, showing not only voltage, output and speed on every unit and on the total plant, but also recording devices which give permanent records of the output and the conditions of temperature and use under which that output was obtained.

This apparatus must be well covered and protected. At the same point the telephone station and the general office for the plant can be placed. From here all parts of the station must be easily reached and communicated with.

In any station some degree of separation between this delicate apparatus and the massive machinery on the main floor is made. The placing of the main room and the switchboard in separate buildings is sometimes considered good practice in steam plants of large size.

In severe climates the switchboard is almost always enclosed and this small room heated. While the efficient working of the board requires it, this has the disadvantage of providing a comfortable room into which all the floormen and operators are inclined to drift to the disadvantage of the station at large. If as is proposed in this article all the operating functions are assembled in this room, or in galleries extending from it, this natural grouping of the operating force becomes an advantage of the arrangement, bringing all the men to a central point ready for emergency service at any part of the plant.

Crane.

In the standardized power plant of today the main floor is supposed to cover and carry all heavy pieces of apparatus. For rapid handling during repairs there is installed a power-driven overhead travelling crane spanning the room and capable of lifting from 10 to 75 tons. Most of the actual routine work in the plant calls for the handling of pieces weighing a few hundred pounds. For these the crane usually has a small auxiliary hook. Most of the area enclosed in the plant is due to the height required to get efficient use out of this crane. Part of the floor area is due to the need of room beneath it in which to store parts of disassembled machines.

In an open air station a gantry crane spanning only the main machines will be used to handle the heavy parts. Its lift will be sufficient to carry parts over assembled units. It need have no spare width as storage can be placed beyond the power plant proper at any point to which the track can be extended.

Small parts and apparatus not under the main crane can be handled by a small motor-driven movable crane such as is used to serve lathes and planers in machine shops.

While being opened the electrical apparatus will need protection. For this purpose the gantry will be enclosed and fitted with side curtains sufficient to protect any apparatus beneath it.

The transformer yard and switching station would also deliver transformers and switches to the gantry by direct or cross tracks on which the units would be rolled until under the crane.

During construction the gantry tracks would be extended across a long materials yard in which parts would be stored entirely out of the way until needed,

Portion.	Enclosed Station.	Open Station.
Roof	Yes	No large enclosure.
Walls, windows	Yes	No large enclosure.
Floor	Yes	Yes, but smaller.
Basement	Part	Small.
Crane	Traveling	Gantry.
Craneway	On walls	On ground.
Area served	Apparatus and gangway	Main units only.
Auxiliary crane	On main bridge	Portable on truck.
Lighting	General interior	Outdoor.
Exciters	Main room	Operator's room on main floor.
Main generators	Open	Enclosed weatherproof.
Main ventilation	Natural	Forced.
Noise	Extreme	Slight.
Bearing	Ring oiling	Water-cooled, tight cans.
Governor	Main floor	In operator's gallery.
Control board	Main room	Enclosed and containing all the mechanical and electric control and recording apparatus.
Wiring, low tension	Ducts	Ducts and open.
Wiring, high tension	Ducts	Open
Switches and transformers	In cells	Outdoor type.
Detail attention	Entire plant and building	Governors, control board and indicating instruments.

As an example for comparison consider the Kern River Station of the Southern California Edison Company which the writer designed and built about ten years ago. The station, considered to embody the best ideas of the time, is still spoken of as an up to date plant.

Each unit consists of a 5000 kw. revolving field generator 2300 volts three phase 50 cycles running 250 r.m.p. driven by two impulse wheels overhung on the ends of the shaft. These two wheels are governed in common by a governor set opposite the generator. The control is by deflecting the nozzles followed by hand regulation of the needles.

The main valves are set in the generator room and have hand and motor control. Wasted water is "killed" on double baffle plates before reaching the tail race.

The transformers and high tension oil switches are set in concrete cells opening from the main room and arranged to deliver injured apparatus under the main crane.

At the time this station was built the suspension insulator was undeveloped and the outdoor switch and transformer not yet possible. 75,000 volt leads under even the most careful protection were considered to be a great hazard.

The crane span and lift were kept to the extreme minimum which would permit of handling the parts of the machines. The clearance is insufficient to permit of lifting out the active parts of a transformer and a pit to the basement is provided into which the case is lowered when the interior is to be removed. This arrangement, made as a move toward economy, has proven to be advantageous as both the case and the coils are accessible from solid floors.

In the proposed alternative station the same general dimensions are used for the apparatus, although it is possible that the other alterations would result in a considerable decrease in sizes for the same output.

The same type of speed control is shown. It is likely that a new plant would have the other type of control, but the space used would be nearly as great.

The separation of the governor head and the cylinders would be less than is already in use at the Big Bend plant of the Great Western Power Company and elsewhere. The decrease in the enclosed areas, 434,000 cu. ft. in the old to 22,050 cu. ft. in the new style plant, is so great as to warrant careful study.

The floor areas do not vary so much, as the outdoor generating apparatus will require about the same foundations as will the others, while the foundations for the outdoor transformers and switches will be nearly as massive as those they would be set on inside, while the walks and runways to reach them would be longer.

There is a consideration in this connection which is more important than first cost and operating facility and that is safety. Not only would enclosed generators be free from accidental injury due to leaky roofs or careless handling of other objects while close to the generators, but they would also be free, if installed in the open, from danger due to the failure of any part of the adjacent units.

There have been many cases of the complete destruction of the contents of waterpower plants, and almost without exception the damage has progressed from one unit to another due to open construction in a restrained area.

At a well known plant in Oregon a governor failed to control the speed. The generator eventually exploded from excess speed and flying parts damaged other governors, while flames from the shortcircuited windings completed the destruction of the entire equipment.

A runaway wheel in an outdoor plant could completely vanish without disturbing the neighboring units.

At a large station in California equipped with high head turbines and open type generators, a cast iron wheel case burst and flooded the powerhouse. Between water and fire the generators, wiring and governors were practically ruined.

In an open station the flow from an injured casing, even the full flow of a broken penstock, could cross the floor and flow away without wetting any perishable part.

When utility, economy and safety can all be satisfied by a new construction to a greater extent than by an old, it is but a brief time until the newer work must become popular.

Evaluation of Portland Railway, Light and Power Company has been completed by the Oregon Public Utilities Commission after three years investigation. The reproduction cost new of the utilities is fixed at $45,375,027.19 in preliminary findings of fact. Upon this as a basis the commission will next determine rates. The inventory and appraisal submitted by the utility claimed a total value of all its property, including its value as a going concern, as of June 30, 1915, of $61,040,004. In this figure the utility included $7,489,446 as "going value," which is not included in the figure found by the commission. The commission also reduced the utility's claim for water right and real estate value, reduced percentages for overhead costs and decreased the amount claimed as working capital.

PROSPECTIVE POWER MARKET FOR IRRIGATION PUMPING.

BY JOSEPH JACOBS.

(Continued.)

Celilo power costs.—In the preliminary report upon this power project, rendered in 1912, a base rate of $9 per h.p. at the generating station was named for general power and $5 per h.p. per year was named as a possible charge for irrigation power, this latter figure being less than cost and in the nature of a subsidy to agricultural development, any immediate loss involved therein to be absorbed in the rate fixed for general commercial power. Such action might be entirely justified, but it would no doubt require legislative authority and the lower figure could not, therefore, be adopted as a basis for present estimates.

It is my understanding that the more recent studies of the Celilo development give no warrant for lowering the figure first above quoted and one suggestion as a rate for irrigation power has been as follows: A base rate of $9 per h.p. per year at the generating station, to which would be added a rate to cover the annual cost of transformation and transmission, these rates to be on a connected load basis and the full yearly charge to be made for the irrigation season on the assumption that there would be no market for the auxiliary power during the non-irrigation season. This would impose upon irrigation a rate in excess of that charged for all year industrial power, and it seems to me it should be somewhat reduced for the following reasons:

a. It is probable that a winter load to the extent of at least 5 per cent of the summer irrgation requirements could be developed; the normal demand for light and heat and general purposes other than irrigation being greater in the winter than in the summer. On the Minidoka project in Idaho, a winter load amounting to about 15 per cent of the summer irrigation load has been developed.

b. Depreciation of the generators and turbines at the power plant for a seven months' operating season would be appreciably less than that for a twelve months' operating season.

c. Cost of attendance at the power station would be somewhat reduced.

d. Cost of waste, lubricants and miscellaneous repairs to generators and turbines would be reduced.

e. The maximum load paid for by irrigation would not be carried at the power station, and furthermore peak loads for the different projects would not occur at the same time, and the power house installations therefore would probably not need exceed 75 per cent of the total connected irrigation load, assuming a large irrigation development.

Taking cognizance of all of these factors, I think it probable that the actual cost of delivered power, taken on a basis of connected load and for the average irrigation season, would not be in excess of 80 per cent of the cost of all year continuous power, and while I have hesitated to take this figure as basis for my estimates I have adopted as a rate for irrigation power 90 per cent of the cost of all year continuous power.

Limiting power costs.—The limiting charge for Celilo power delivered at any particular point would be a price at which power from other sources could be delivered to the same point. In some cases competition will be had with nearer electric power developments, whose shorter transmission distance will make possible rates at which Celilo power could not be delivered. In other cases, where long transmission and small amounts of power are involved, and because small amounts of power cannot be economically transmitted long distances, competition might be had with steam or gasoline or gas engine plants. The more recent developments in the field of internal combustion engines forecasts a certainty of very cheap power from that source, and I am of the opinion that by the time the Celilo power could be made available such plants will be able to compete with electric power at one-half cent per kilowatt hour for Columbia River points in Oregon and Washington.

Engines of the Diesel type, for instance, which for the first dozen years of their exploitation in this country were somewhat experimental and perhaps two complicated, are now offered by several American manufacturers upon a reasonably safe and conservative basis both as regards price and constructive details. The best recent tests of this type of engine have shown fuel consumption as low and in some cases lower than one-half pound of crude oil per brake horsepower hour, which for California petroleums means from 1/15 to 1/16 gallons per horsepower hour, or approximately 1/12 gallon per kw.-hr.

The present price of crude oil for North Pacific Coast points is about 85 cents per barrel, or 2 cents per gallon, and at present railroad freight rates I estimate that its cost laid down at pumping stations along the Columbia River will be from 4 cents to 4½ cents per gallon. The cost of fuel alone, therefore, would be about 0.35 cents per kw.-hr. and including an allowance for interest, depreciation, taxes, attendance, lubricants, etc., I estimate a total present cost of approximately 0.80 cents per kw.-hr. for installations of 200 h.p. capacity.

Comparing such an installation with one having an electric motor drive we must include in the latter the cost of switchboard, stepdown transformers and the motors themselves and exciters for same if the motors are to be of the synchronous type. The cost of all these in place, however, would probably not exceed one-third the cost of the oil engine installation above considered and the fixed charges on same would therefore be proportionately less. Exclusive of the cost of electric current I estimate the power cost for this installation to be 0.17 cents per kw.-hr., thus leaving a margin of about 0.63 cents per kw.-hr. as available for electric current to place the two types of installation on a parity as to final cost of power.

Looking ahead, however, we may confidently anticipate a reduction in factory cost of oil and gas engines and, with the improvement of the Columbia and Snake Rivers for steamer transportation, we may also anticipate a material reduction in freight rates to river points. The former would reduce fixed charges and the latter would reduce fuel costs for all pumping installations of that character and these conditions are my premise for the assertion made in the initial paragraph that such plants would later on be able to compete with electric power at one-half cent per kw.-hr. I have therefore thought it proper to ex-

clude all projects, however attractive they might be, where it appeared that the cost of delivered Celilo power would be in excess of that figure and a number of small projects were thus eliminated.

Permissible lift.—I have sought to determine in a general way what pumpage lifts would be economically permissible with irrigation power at rates that the Celilo development would make possible. In pursuing this study I considered a project of 10,000 acres and a farm unit just sufficient to comfortably support a family. I shall not enter into the detail figures of this study at this time further than to say that every item of possible expense attaching to farm operation was included; that land and water right was assumed to cost $100 per acre; that interest was taken at 6 per cent and taxes at 1 per cent of the total investment; that ample depreciation was allowed for all buildings and equipment on the farm; that an allowance of $720 per year was made to the farmer for his own labor and that conservative figures were adopted for crop yields and crop prices.

The classes of farm investigated and the resultant permissible lifts, upon the bases assumed, were about as follows:

For a 20 acre fruit ranch, representing a total investment of $10,000, a permissible average lift of 1000 ft.

For a 30 acre, one-half fruit and one-half forage ranch, representing a total investment of $11,855, a permissible average lift of 300 ft.

For a 30 acre dairy ranch, representing a total investment of $8,920, a permissible average lift of 35 ft.

For a 60 acre forage ranch, representing a total investment of $9,940, a permissible average lift of 25 ft.

A considerable variation of judgment may obtain as to the several items of cost entering the estimates upon which the above deductions are based, all of which variations will appreciably affect the permissible lift. The result may be to make any single set of figures somewhat illusive or misleading and, therefore, to require the most conservative judgment in their interpretation. If, for instance, the allowance to the farmer for his own labor were changed from $720 to $600 per year, and the latter figure is nearer the average for the United States, it would provide an additional $120 per year for pumpage and would permit lifts for the 30 acre dairy ranch of about 200 ft. instead of 35 ft., and for the 60 acre forage ranch of about 110 ft., instead of 25 ft. as above stated.

The 1000 ft. permissible lift for the 20 acre fruit ranch may well challenge the credulity of some and yet for the conditions assumed; to wit: a project with soil and climate truly adapted to good fruit culture, I do not regard the figure as extravagant. Because of its magnitude, however, and to illustrate the general method of arriving at these permissible lifts I offer, in Appendix A, the detail figures for this case, and I think it will be promptly conceded that the assumptions made therein are entirely conservative.

It would appear from these studies that only those lands contemplating the lower lifts could be devoted exclusively to forage culture or to dairy farming and that the higher bench lands must be devoted largely to fruit and vegetable culture or pumpage to them would be economically impossible. it should be borne in mind too that no extensive body of land in a single project is exclusively adaptable to fruit culture, and also thav diversified farming, with respect at least to the project as a whole if not to the individual farm, is always the wiser plan. These causes would at once inhibit the 1000 ft. lift applicable to the all fruit farm and I think it may be safely assumed that the maximum average lift can practically not exceed 400 ft.

Another important fact disclosed by this study is that from $9,000 to $12,000, as will be noted above, are required to bring these farm properties to a status of normal yield and profit. This indicates clearly the necessity for some form of rural credits and of so financing these projects that the farmer may secure the lands upon long time payments and easy terms in order that he be not crushed during the early years of his establishment upon the farm. This is a most significant fact and I apprehend that failure to so finance these enterprises, whether under some form of government sponsorship or otherwise, will invite disaster or at best impose a most serious handicap on the settler, on the project and on general state development.

(To be continued.)

REPORT OF N. E. L. A. ELECTRIC RANGE COMMITTEE.

(Continued.)

Apartment House Cooking.

The electric range is peculiarly well adapted for apartment house service. The character of construction of the buildings, and the mode of living of the tenants, make it ideal.

Space in an apartment house especially in the kitchen is usually limited. The advantage of a compactly constructed electric range is therefore apparent.

A range in an apartment is only needed for cooking operations, as hot water and heat are usually supplied from the basement. This condition makes the electric range far superior to fuel burners.

Apartment house tenants move frequently. Each new occupant insists on having the woodwork repainted and the walls retinted and repapered. The very nature of the electric range which does away with all smoke, grease, dirt, and filth makes this expenditure on the part of the owner unnecessary.

The utensils used on an electric range are easy to clean both inside and out on account of the absence of soot and burned foods. This makes the kitchen work easier, quicker and more attractive to the tenants.

Silverware tarnishes quickly where fuel stoves are used. Such is never possible, however, where the cooking is done electrically, as there are no products of combustion.

Many people are careless and fuel stoves in apartment houses are a constant menace. The danger of loss of life and property by fire is entirely removed where electric ranges are used.

Occupants may be asphyxiated by the use of gas as a result of the supply being temporarily cut off; on account of children carelessly opening the valves; or through mistake of the cook or housewife. The user of an electric range is absolutely free from all danger.

The ventilation in apartment house kitchens is often very poor and where some fuels are used the fumes are poisonous and the fire is constantly burning oxygen out of the air. The electric range on the other

hand gives off no poisonous fumes and destroys no oxygen whatever.

Small kitchens being the rule rather than the exception in an apartment house, the heat from a fuel range often becomes unbearable. The housewife using an electric range can dress before preparing a meal and be assured that she will suffer no discomfiture whatever on account of the heat.

From the central station company's standpoint the apartment house business is very desirable. The load is mostly of an off-peak character. The load factor is good. The diversity factor is not excelled by any other class of business and the demand is high. Curves taken on several large apartments show that the connected load in cooking apparatus is often as great as seven times that of the maximum demand. The apartment house business is easily the most attractive cooking load that can be secured.

It is the opinion of the sub-committee that the magnitude of the electric range business in the future is largely, if not entirely up to the manufacturers to determine. In other words, the efficiency, durability, flexibility and price of the coming electric ranges will govern the volume of business which is to be handled.

It is apparent that in the Pacific and Rocky Mountain states the central stations are alive to the importance of this field of development, and it is also apparent that an interest is being created in electric cooking in all parts of the country from the Pacific to the Atlantic. The public is becoming curious as to what are the advantages of electric cooking, and this curiosity may be easily changed to desire, if the products of the manufacturers fulfill the requirements and meet the conditions laid down.

There must be constant improvements in developing the range itself. At the present time it has become the custom to say "develop the electric range along the lines of the modern gas range." This is a good basis upon which to start, but the future development of the electric range may be along lines of its own, rather than a continual imitation of the gas range.

When the first automobiles were put upon the market they resembled buggies and carriages formerly drawn by horses, but gradually the automobile manufacturers have developed machines with entirely different lines, better adapted for the work which is put upon them. It is quite probable that the development of the electric range will point in a similar direction.

For some time past there has been a fear on the part of electric range manufacturers and central station managers that the electric cooking load would seriously affect the daily and annual peak of the central stations, and consequently there was a tendency to keep down the size and capacity of the burners. However, experience has demonstrated that the cooking load will not seriously affect the peak, and that under ordinary conditions, owing to the diversity factor, not more than 10 per cent of the connected load in electric ranges is likely to come upon the peak at one time. Consequently there need not be the fear of increasing the capacity of the burners so that the cooking may be done more quickly, and thus better meet the competition of other fuels.

The most important factor in the satisfactory operation of an electric range is the heating element. It is essential that the burners be constructed initially so that they will be able to withstand the use and abuse which may be put upon them. It is absolutely essential that the heating elements which are liable to burn out should be readily and quickly replaced, so that there may be no unnecessary delays in repairing. The average housekeeper is willing to pay the price for the service upon the condition that cooking can be done quickly, and with as little trouble for repairs as is caused by other cooking appliances and other fuels.

The majority of central stations interested in the development of the electric range business are willing and anxious to make liberal expenditures and concessions in order to induce consumers to cook by means of electricity, and such matters as adjustment of rates and local advertising will undoubtedly receive the attention they deserve from central station managers.

The manufacturers will still require to co-operate with the central stations after sales have been made, so that owners of electric ranges may be thoroughly instructed regarding their operation and durability. It is as much to the advantage of the manufacturer to follow up a sale as it is to the central station and such work intelligently done will produce results which will be altogether desirable.

The properly constructed electric range has all the good points of older methods of cooking without any of their disadvantages. It has also many advantages which are not possessed by other cooking appliances. However, the public is not informed regarding the advantages and operation of the electric range, and while interest is being created in the subject, there is still a note of interrogation in the public's mind. Education and demonstration will overcome doubt and want of knowledge, and the proper education of the public can only be brought about by the earnest co-operation of the manufacturers themselves and then between the manufacturers and the central stations.

(To be continued.)

The U. S. census of the gas industry for 1914 shows that of 1284 establishments reporting, 427 produced carbureted water gas; 274, straight coal gas; 156, mixed coal and water gas or mixed coal, water and oil gas; 150, oil gas, and 165, acetylene. The principal product of the remaining establishments, 112 in number, was gasoline gas. The 150 oil-gas plants included 61 which manufactured Pintsch gas and 4 which produced Blau gas; and the 165 acetylene plants included 36 which distributed the gas in containers. The gas prod- and 1 each in Arkansas and Wyoming. The gas products comprise 203,730,191,000 cu. ft. of gas, valued at $175,065,930, consisting of 10,509,946,000 cu. ft. of straight coal gas, valued at $10,726,514; 90,017,725,000 cu. ft. of carbureted water gas, valued at $74,516,534; 86,281,339,000 cu. ft. of mixed coal and water gas, valued at $72,012,021; 16,601,805,000 cu. ft. of oil gas, valued at $15,044,509; 137,964,000 cu. ft. of acetylene, valued at $2,511,634; and 181,412,000 cu. ft. of other gas, chiefly if not entirely gasoline gas, valued at $254,718.

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The semi-annual index for Vol. XXXVI, which is completed with this issue, will be sent upon request to any subscriber.

Scientific Management of Power Plants

The remarkable results attained in the scientific management of factories have frequently been referred to as indicative of what might be accomplished with more scientific management of electric power companies, scientific management being considered as a means for lessening cost of output. While this view is, in a measure, true, the business of supplying electric current differs from the business of making machinery in that the output of one is service and the other pieces.

In the power business, reduction in cost must yield precedence to safety first and continuity of service. One of the chief points of difference between a power plant and a manufacturing plant is that the selling price of the former's product is based primarily upon the character of the service rendered. New ways of enhancing service to the public are needed more than new ways of lessening costs.

The wonderful increase in efficiency of plant operation has been due primarily to the manufacturer of the apparatus employed. Boilers, prime movers and generators show increasingly higher efficiencies. These, in the aggregate, are far greater than any economies that may be effected by more efficient operation of the apparatus.

The commercial side of a proposition often preponderates over any saving that might be made by its adoption. A power company finds that it can make certain articles cheaper than they can be bought from the regular manufacturer, but may be faced with the fact that the manufacturer as a power consumer pays many times the proposed saving for the current he uses.

This does not mean that every effort should not be made to find costs, but merely that any suggested reduction be tempered with judgment. It does not mean that there should be any let up in trying to improve operating efficiencies, for in this way it is possible to improve service and further safety without increasing rates.

Corporate Friendship

Now that assertion of the management's personality has enabled most public service corporations to live down the stigma of soullessness it is time that the corporation begin to cultivate a few personal attributes. The noblest of these personal acquirements, and the one most to be sought, is the capacity for friendship. A corporation without friends is more to be pitied than a man in similar plight.

Many a man has lived to regret the day when he thought that he had no time to make friends. With a corporation the situation is even intensified; friends are an asset worth cultivating. Any corporation may well ask itself what is the value of financial success if, in attaining it, friendships have been sacrificed.

A corporation's closest friends should be its em-

ployees. When they are always looking out for its interest, saying a good word for it at every opportunity, stopping slanders, nailing lies, correcting false impressions, and overcoming prejudices created by some mistake, the public, in turn becomes friendly. The private acts of employees can do more to make or mar public feeling toward a corporation, than the public acts of the corporation's officials.

Friendship is impossible without reciprocity. The only way to have a friend is to be one. In order that a corporation gain the esteem and respect of the public it should exhibit a similar esteem and respect toward the public. Friendship must be given before it can be taken.

Friendship is sincerity dissolved in sympathy. The strength of the solution depends upon the sincerity of the motive prompting friendship. The mutuality of friendship and consequently its existence is destroyed by pretense. Without truth there can be no friendship.

Sympathy is the universal solvent without which no motive can be understood. It is sympathy, or tenderness, that also gives friendship its evanescence, Like the most delicate blossom it disintegrates with the lapse of time.

Emerson once wrote something about conversation being the consumation of friendship. For the group friendship, symbolized by public good will, publicity and approachableness, are the substitutes for private conversation.

Such publicity should be largely directed toward showing the public how it is being benefitted by the corporation service. It should be calculated to win and hold public confidence.

The Engineer and the Weather

To build a hydroelectric plant out of doors, on first thought, seems a most startling innovation. But as detailed elsewhere in this issue by Mr. Ralph Bennett, the advantages of so doing in some respects are greater than the advantages of an expensive structure built to protect the apparatus against the weather. This is particularly so in the Pacific Coast localities where inclement weather is the exception rather than the rule.

Approved modern practice in the construction of power plant apparatus has tended more and more toward complete individual housing. But few changes in design would be necessary to provide watertight cover for every device. The resulting reduction in first cost may offer a solution to the problem of hydroelectric competition with steam power plants. Furthermore, safety would be enhanced and operation would be facilitated.

The criticism that this proposal has provoked brings to mind the caustic comments on the first outdoor substations. That the outdoor substation has since proven an unqualified success suggests that judgment at least be withheld until the idea has been tried out in practice.

The chief function of the engineer has always been to combat weather. In designing a bridge, a transmission line or a building, due allowance is always made for wind pressure. Wherever people are housed adequate protection must be provided to temper extremes of heat and cold. Comfort and health also require that rain and snow should be excluded. But when sufficient cover is provided for operators, and when each machine is individually protected, some of these precautions seem unnecessary in power plant construction.

Talking of the weather, except for sailors and farmers, no class of people are more interested in climatology than engineers. Probable temperature extremes always govern engineering design, if for no other reason than to guard against expansion and contraction. Records of rainfall are indispensable as a guide for irrigation and water power plants. However, it should not be forgotten that disastrous experiences have demonstrated the danger of too much reliance on such data, or at least of an improper interpretation thereof. The failures of several Western irrigation projects due to this cause furnish evidence not to be forgotten.

Another weather factor to be considered by the engineer is humidity, which greatly influences the design of cooling ponds for refrigeration or condenser work. San Francisco, with a summer humidity of 75, requires greater cooling surfaces than Yuma with a humidity of 16 or less.

Other instances will undoubtedly suggest themselves to the reader as to the desirability, from an engineering standpoint, of a continuous and accurate record of atmospheric pressure, temperature, rainfall, direction and velocity of the wind, and evaporation. If for no other purpose than to construct dams, spillways, headworks, bridges and levees against floods, such information is essential to the well-being of the people.

Considerable criticism has lately been directed against the U. S. Weather Bureau for negligence in furnishing more complete information in this respect. Several Southern California members of the American Society of Civil Engineers have contributed papers and discussions to the Society's Proceedings. Strangely enough the answer to these criticisms was published in the Journal of the Cleveland Engineering Societies nearly a year after the first paper was published. The main points in extenuation were that the Bureau was doing the best it could with the means at its disposal and considering the needs of other classes besides engineers.

Further presumption on the license which is afforded by the changeableness of the subject of this desultory discourse makes it opportune to also call attention to the effect that the weather has on labor conditions on the Pacific Coast. Snow is almost unknown except in the extreme north or at the highest altitudes. Construction work usually proceeds uninterruptedly throughout the winter. In the summer also there is seldom such a combination of hot weather and great humidity as to hamper workers.

PERSONALS

H. J. White, manager of the Keeler-White Company, at San Francisco, is in Chicago for a month.

Paul M. Lincoln, engineer with Westinghouse Electric & Manufacturing Company, is at Los Angeles.

H. J. Verfurth, of the Central California Electric Company of Lindsey, was a recent business visitor at San Francisco.

G. F. Chellis, formerly with the J. G. White Engineering Corporation, at San Francisco, is now located at the New York office.

B. J. Klein, Pacific Coast manager of the Bristol Company, has just returned from a short business trip throughout the San Joaquin valley.

W. S. Greenfield, manager of the San Francisco office of the H. W. Johns-Manville Company, is at Los Angeles to be gone for a couple of weeks.

C. C. Hillis, general manager of the Electric Appliance Company, recently returned to San Francisco from a short business trip to Los Angeles.

Jas. F. Pollard, assistant engineer California Railroad Commission, has returned to San Francisco from his annual vacation and resumed his duties.

Jos. Thieben, manager of the Panama Electric Lamp Company at San Francisco, is leaving for a three weeks' vacation at Pines, in Madera county.

Roy S. Roylance, mechanical and electrical engineer of San Francisco, has left for Kennedy, Humboldt county, Nevada, where he has engineering and mining interests.

C. A. Reynolds has resigned as member and chairman of the Washington Public Service Commission, to enter into private law practice. No successor has as yet been considered.

J. Skog, who controls one of the largest electric power concerns in Sweden, is a recent visitor at San Francisco. Mr. Skog has been on a tour of inspection of the power plants of the United States.

C. F. Green of the E. L. Knight Electric Company, of Portland, Oregon, has gone to the National Electrical Contractors' Convention, in New York, as official delegate from the Oregon association.

S. P. Russell, manager of the electrical department of the H. W. Johns-Manville Company, has returned to San Francisco from a two weeks' trip to Los Angeles. Mr. Russell leaves for Fresno next week.

W. C. Miller, of the Southern Pacific Company's electrical staff, left this week to attend the annual convention of the American Institute of Electrical Engineers as the delegate from the San Francisco Section.

H. H. Corey has been appointed member of the Oregon State Public Service Commission to succeed **Clyde A. Aitchison,** who resigned to become solicitor to the National Association of Railroad Commissioners. Corey has been secretaary of the commission and at the May primary was nominated as the Republican candidate for commissioner from the eastern Oregon district. **Edward Ostrander,** who has been examiner for the commission, succeeds Corey as secretary.

W. A. Kraner, of the McClenahan-Kraner Carter Co., Inc., engineers and contractors of San Francisco, recently secured a $175,000 contract for the irrigation development of the Alpaugh Irrigation District of Tulare county, which consists of 26 miles of distribution system of riveted steel pipe lines, five 12 in. wells 1250 ft. deep, 8 new pumping installations on the present wells, 65,000 gal. 100 ft. steel tower and tank with a pumping station for domestic supply purposes and it also consists of rebuilding six miles of the old canal.

Elmer Dover of Tacoma has been succeeded as president of the Oregon Power Company, a Byllesby interest, by **James A. Green,** who has been manager of the Northern Idaho and Montana Power Company, of which Mr. Dover is president. **Attila Norman** remains as vice-president and general manager of the Oregon Power Company, of whose Willamette Division **J. L. White** of Albany becomes manager. **A. L. Martin** of Dallas is manager of the Coos Bay division and **R. U. Steelquist** of Corvallis has charge of the Dallas division, under the new plan of reorganization.

MEETING NOTICES.

Los Angeles Jovian Electric League.

Every loyal Jovian was present at the luncheon on Flag Day, June 14th, and later marched in the preparedness parade. Henry F. Holland, president of the League, occupied the place of honor at the head of the Jovian League, which lead the electrical and lighting division, which was one of the largest and most representative departments of the procession. The spirit of the day was strongly in evidence at the luncheon, being manifested in stirring, patriotic songs and speeches, the guests of honor being Hon. Geo. S. Patton, General Harrison Gray Otis, and Paul Lincoln, junior past president of the American Institute of Engineers. Geo. S. Patton in his address, predicted that the close of the war would mark a new epoch in the history of the world and the most dangerous and trying era that America has ever faced. General Otis also delivered a brief address, in which he spoke of the career of Major-General J. Franklin Bell, Commander of the Western Department, U. S. A., General Otis also exhibited the flag of the 8th Army Corps, which was carried through the Philippine campaign. Major-General Bell, who was to have addressed the league on the subject of "Preparedness" was unable to be present. A. E. Peat was chairman of the day.

Portland Sections of N. E. L. A. and the A. I. E. E.

The last meeting of the year was held Tuesday evening, June 13th, at the University Club, Portland, Oregon. The following officers were elected to serve for the coming year for the local section of the N. E. L. A.: J. C. Henkle, chairman; E. F. Whitney, vice-chairman; H. H. Schoolfield, secretary; C. L. Wernicke, treasurer. A. C. McMicken acted as chairman pro tem in the absence of both the chairman and vice-chairman of the section.

The results of the written ballot for officers of the local section of the A. I. E. E. was announced as follows: L. C. Merwin, chairman; J. C. Martin, secretary; E. D. Searing, A. S. Moody, P. Lebenbaum, executive committee.

J. P. Groden was the toastmaster at the banquet and the entertainment committee provided the Progressive Business Men's quartet, the Russian dancers from the Hippodrome Circuit, and the Messur Sisters from the Pantages Circuit, as special features for the evening. Short talks were made, during the evening, by Messrs. Lebenbaum, Schoolfield, Merwin, Coman, Henkle and Coldwell. All the speakers agreed that the prime factor in making the meetings of the past year a success was due to the excellent work of the entertainment committee. The average attendance at all the various meetings during the year was 63. The attendance at the banquet was 85.

San Francisco Electrical Development and Jovian League.

The June 14th meeting was opened with a stirring address on preparedness in general and the proposed preparedness parade on July 22d in particular, by Col. Mathewson of the National Guard. On motion duly made and seconded the league agreed to do all in its power to induce its membership to march in the parade under the leadership of President E. M. Cutting. Mr. F. E. Boyd of the General Electric Company, as chairman of the day, then introduced Rev. Albert W. Palmer who gave an inspiring and helpful talk on "Personal

Efficiency." After analyzing the several motives which induce a man to desire efficiency, the highest of which is that cosmic patriotism known as religion, Mr. Palmer first outlined the necessary preparatory steps to personal efficiency, as exemplified by Mr. Purington and then recited the seven fundamental elements of efficiency. Self analysis was given as the first preparatory step, followed by a definition of limitation to determine special aptitude. Then follows a thorough study of the lives of those men who have succeeded along the selected vocation and the beginning of the new life, an effort to improve general health to acquire a more optimistic attitude and to strengthen moral qualities. Mr. Palmer's suggestions as to the seven essentials are (1) integrity of character, a straight, clean, honest and dependable life to inspire the confidence of others, (2) good physical health, planning to do your best work after attaining an age of 50 years, when the background of knowledge and accumulated experience can be the basis of such a work as was done by John Hay, (3) the ability to concentrate and to analyze the job after concentrating, (4) poise and the ability to forget a wrong and not cherish grudges, (5) teachableness, flexibility of ideas and the meeting of disappointment philosophically, (6) co-operation as instanced by welfare work calculated to improve the mental attitude of co-workers, and (7) a form of recreation supplying the features of all-round development lacking in one's regular business, for which church-going is recommended. Mr. Palmer's hopeful talk was more vigorously applauded than any yet given at the league luncheons and heartily bespoke appreciation of his address.

TRADE NOTES.

The Kimball Electric Company of Oakland has established a branch office in the Sheldon Building, San Francisco.

The National Electric Company of San Francisco have installed a large wiring contract for Dr. B. K. Smith at 840-42 Hayes street, and also at Twenty-first and Howard streets.

The Aero Fire Alarm Company has just finished the Letterman General Hospital, Presidio, San Francisco, contract, for installing a complete modern fire extinguishing system.

The Drendell Electric Mfg. Co. are installing the switchboards for the new San Francisco Library and have recently completed a new Safety First board that is always a necessity in public buildings.

The Northwestern Electric Company has opened a handsomely equipped free cooking school in the Pittock block, Portland, and will conduct classes in home economics. Mrs. L. M. Hayes, home economist, who will have charge of the lectures, is a well known expert in the line of home economics, and her lectures promise to be of unusual excellence and value. The new "Cook by Wire" store is tastefully finished in white enamel throughout.

Charles T. Phillips, consulting engineer, at San Francisco, has just completed plans and specifications for the electric wiring and illumination of the twelve story office building that will be erected on the corner of Second and Market streets, San Francisco, for the Savings Union Bank & Trust Company. These plans were prepared for Mr. John S. Drum, President of the bank. The Santa Fe railroad offices will occupy the first four floors.

NEW CATALOGUES.

"Something in It for You" is the striking title of an attractive booklet just issued by the Westinghouse Electric & Manufacturing Company in order to assist its agents and dealers in marketing the Westinghouse Electric Range. This booklet describes in a brief concise manner the advantages of this type of range together with a number of illustrations, and in addition outlines several methods of selling them and gives some suggestions covering newspaper advertising, window trims, demonstration, etc.

CALIFORNIA ELECTRICAL CONTRACTORS' WINDOW DISPLAY SCHEDULE.

Week of July 19th to 20th—Irons. With suggestions for summer use.

Week of June 26th to July 3d—Fourth of July decorations with flash-lights, fans.

July 3d to 10th—Vacation needs, vacation comforts. A few flash lights, water heaters, small fans, shaving cups, No. 92 plug clusters, toasters, cone shades, percolators, lamps.

July 10th to 17th—Fans.

July 17th to 24th—Heating appliances, grills, toasters, etc.

July 24th to 31st—Vibrators, vacuum cleaners.

July 31st to August 7th—Lamp display.

August 7th to 14th—For late vacationists. Repetition of July 3d to 10th window with a few alterations in trimmings.

August 14th to 21st—Miscellaneous everything electrical.

August 21st to 28th—Batteries, bells and push buttons.

CONVENTION OF CALIFORNIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS.

The Seventh Annual Convention of the Association will be held at Stockton, July 14-16, 1916. The following program is tentative:

Friday, July 14—

8:00 a. m.—Executive committee meeting.

11:00 a. m.—Opening of the convention; address of welcome, etc.; business session (for members only).

2:00 p. m.—Joint meeting of members C. A. E. C. & D., Jobbers and central station members. (Note: A card tournament has been provided for the entertainment of the ladies during the afternoon. Valuable prizes for the winners.)

7:00 p. m.—Roof garden dinner dansant. (Admission to all ticket-holders.)

Saturday, July 15—

8:00 a. m.—Unfinished business; election of officers. (members only.)

10:00 a. m.—"Trade Acceptances," address by Mr. Russell Lowry, president the First National Bank of Oakland, Cal.

2:00 p. m.—"Our Relations to the Mercantile World." Addresses by men prominent in the architectural, mercantile, hydroelectric and organization fields.

Auto tour through surrounding territory.

7:00 p. m.—Banquet. (Admission to all ticket-holders.)

Sunday, July 16—

Steamer trip on the sunny San Joaquin.

As this entire period is the season for flash light sales, it is suggested that when they are not displayed in windows they be put in prominent places inside the store.

ORGANIZATION OF ENGINEER BATTALION FOR MEXICAN SERVICE.

Immediately upon notice of the seriousness of the Mexican situation, Mr. J. W. Swaren of San Francisco, who has been taking an active interest in the Engineer Corps of California, conferred with officers of the regular army and decided to organize an engineer battalion to be associated with the National Guard of California. This is being organized in the expectation of active service. All engineers qualified to serve as commissioned or non-commissioned officers are urged to present their qualifications at once, as a necessary preliminary to the enlisting of mechanics as first and second grade privates. Further details regarding this matter will be published next week.

NEWS NOTES

ILLUMINATION.

SAN ANSELMO, CAL.—Property owners have petitioned the city trustees to install electroliers along San Anselmo and Bolinas avenues.

SEATTLE, WASH.—A franchise has been granted to the Lake Forest Light and Power Company in Lake Forest second and third additions.

BATTLE MOUNTAIN, NEV.—A petition of the citizens of Battle Mountain for an extension of the lighting system has been referred to Commissioner Schmith.

RICHMOND, CAL.—Equipment is being hauled in for paving Twenty-third street from Macdonald avenue north. Electroliers will be placed along the street after it is paved.

CORVALLIS, ORE.—There is considerable agitation in Corvallis for a municipal lighting and power plant, and unless the rates of the Oregon Power Company are lowered the matter will no doubt be taken up through public meetings to determine if there is sufficient sentiment to start a campaign for a bonding election for this purpose. The flat rate in the city is 10 cents per kilowatt hour.

TRANSMISSION.

SALT LAKE CITY, UTAH.—Manager George Nichols says electrical machinery will soon be installed at the property of Lehi-Tintic Company in North Tintic District.

SALMON RIVER, CAL.—Carl Langford, superintendent of the electric power plant that will be installed at the mouth of Salmon river, has a crew of men at work. They will have to drive 100 ft. of tunnel before the power system can be installed.

WOODLAND, CAL.—The Northern California Power Company, Consolidated, has made application for a franchise to erect poles and wires for transmitting electric current in Yolo county. Sealed bids will be received for said franchise up to July 11th.

OKANOGAN, WASH.—The Similkameen Power Company plant has been sold to the Okanogan Valley Power Company for $45,000 cash and 60 shares in the latter company at $100 per share. The new owners announce that they will make considerable improvements both in plant and transmission line at an early date and will connect the plant with their Methow Valley plant.

FRESNO, CAL.—The San Joaquin Light and Power Company is preparing to make extensions in the Fresno district that will cost approximately $75,000. It is reported that about 65 miles of new lines will be placed in the following towns: Fresno, Selma, Caruthers, Riverdale, Corcoran, Bakersfield, Midway, Santa Maria, Los Banos, Dinuba, Madera, Merced and Livingston.

TRANSPORTATION.

RENO, NEV.—Permission has been granted to the Reno Traction Company to lay tracks to the racetrack.

HILO, T. H.—The Hilo Electric Company has been bought out entirely by C. C. Kennedy and H. V. Patten.

LODI, CAL.—The Board of Trustees granted W. T. Owens permission to construct an electric railroad over certain streets of the city.

STOCKTON, CAL.—The Tidewater Southern, now operating an interurban electric line between Modesto and Stockton, may be extended to Turlock to tap that rich district as a feeder for the Western Pacific.

MARTINEZ, CAL.—The city trustees have granted a franchise to the Martinez-Concord Interurban Railroad to construct the first unit of the main line linking the two cities. The unit will cost about $25,000.

PORTERVILLE, CAL.—It has become known that the extensions to be constructed south from Adobe station to the newly-opened orchards in the Deer Creek district will be constructed by the Pacific Electric Company and will be later leased to the Southern Pacific for operation.

SAN FRANCISCO, CAL.—The Board of Public Works will receive sealed bids up to June 28 for track special work for the Municipal Railways. It has been decided that work is to begin immediately in connecting the Van Ness avenue and Church street extensions of the Municipal Street Railway system by building tracks along Market street.

IRRIGATION.

SACRAMENTO, CAL.—W. O. Hamilton and C. M. Berry, president and secretary, respectively, of the Imperial Irrigation District, comprising 512,000 acres in Imperial County, were in Sacramento recently to consult with State officials relative to matters appertaining to the validation of the district's bonds of approximately $3,500,000.

OAKDALE, CAL.—Plans for a joint storage reservoir with the Utica Mining Company were halted by the Oakdale irrigation board, when protests were received from the largest land owners in the district, who declared that the district has no present need of storage and insisted that it was folly to invest $600,000 in the mining company's proposition when the stored water might not be used for ten years.

HANFORD, CAL.—R. H. Mills of the Kings County Development Company is busy getting signatures to the proposed Tulare Lake Water Reclamation District which comprises some 266,000 acres in Tulare Lake bottom. Mills will present the petition to the supervisors as soon as he has the required 51 per cent of names. It is proposed to issue $6,000,000 worth of 20-year bonds.

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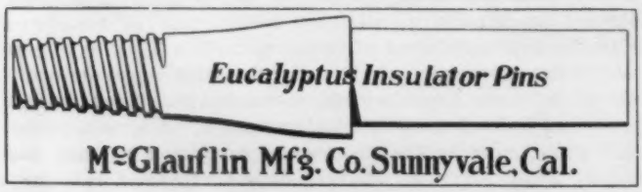

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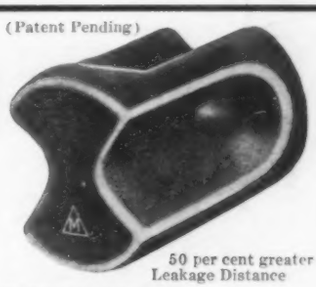

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ANNOUNCEMENT

THE agreement under which the Holophane Works of General Electric Company has had the exclusive right of manufacture and sale of Holophane prismatic glass in the United States, expires on December 31st, 1915. This makes it necessary for the General Electric Company to discontinue the use of the name Holophane in the title of its selling organization which has handled this glassware.

¶ Therefore, on January 1st, 1916, the title Holophane Works of General Electric Company will be replaced by that of Ivanhoe-Regent Works of General Electric Company.

¶ All orders for Regent glass, and Ivanhoe metal reflectors, will be handled at Cleveland, Ohio, by the same organization as before; and this organization will also offer for sale the Holophane prismatic line of glassware.

¶ The owners of the Holophane letters patent have established an office in New York City, but their organization should not be confused with the Ivanhoe-Regent works.

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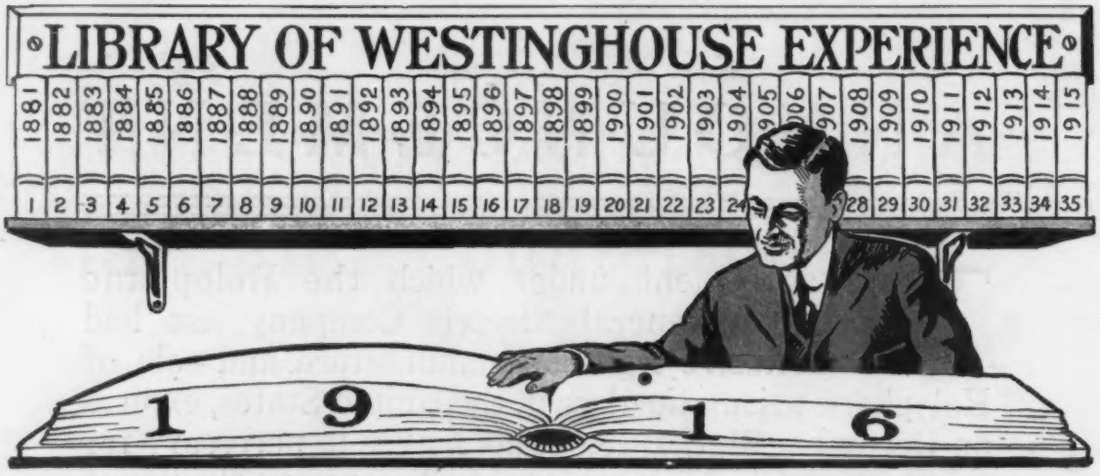

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The letter and number before each name are used in the classified page preceeding

A-1 American Ever-Ready Works of National Carbon Co..
Los Angeles; 755 Folsom St., San Francisco; Seattle.

A-2 Atchison, Topeka & Santa Fe Railway Co.....
673 Market St., San Francisco; 1218 Broadway, Oakland.

B-1 Baker-Joslyn Company..... 3
71 New Montgomery St., San Francisco; 911 Western Ave., Seattle; 353 E. Second St., Los Angeles.

B-2 Benjamin Electric Manufacturing Co.....
590 Howard St., San Francisco.

B-5 Bridgeport Brass Co..... 2
(See Pierson, Roeding & Co.)

B-7 Busch-Sulzer Bros.-Diesel Engine Co.....
Rialto Bldg., San Francisco.

C-1 Century Electric Co..... 12
906 So. Hope St., Los Angeles; 56 Natoma St., San Francisco; 65 Front St., Portland, Ore.

C-3 Crocker-Wheeler Co.....
Salt Lake City; Crossley Bldg., 618 Mission St., San Francisco;

C-4 Cutler-Hammer Manufacturing Co.....
579 Howard St., San Francisco; Morgan Bldg., Portland, Ore.; San Fernando Bldg., Los Angeles.

D-4 Davis Slate & Manufacturing Co..... 3
Chicago, Ill.

D-2 Dearborn Drug and Chemical Works..... 7
355 East Second St., Los Angeles; 301 Front St., San Francisco.

E-1 Edison Lamp Works of General Electric Co.....
Rialto Bldg., San Francisco; 724 So. Spring St., Los Angeles.

E-2 Edison Storage Battery Supply Co..... 7
441 Golden Gate Ave., San Francisco.

E-4 Electric Storage Battery Co..... 3
Pacific Electric Bldg., Los Angeles; Spalding Bldg., Portland; 118 New Montgomery St., San Francisco; Colman Bldg., Seattle.

E-5 Electric, Railway & Manufacturing Supply Co..... 7
34 Second St., San Francisco.

F-1 Fairbanks, Morse & Co.....
Los Angeles; Portland; 651 Mission St., San Francisco; Seattle; Spokane.

F-3 Federal Sign System (Electric).....
618 Mission St., San Francisco.

G-1 General Electric Co..... 10-11
724 So. Spring St., Los Angeles; Worcester Bldg., Portland; Rialto Bldg., San Francisco; Colman Bldg., Seattle; Paulsen Bldg., Spokane.

G-1 General Vehicle Co.....
1117 Van Ness Ave., San Francisco; 331 Wall St., Los Angeles; British Columbia Electric Ry., Ltd., Vancouver, B. C.

H-1 Habirshaw Wire Co.....
(See Western Electric Company.)

H-2 Hemingray Glass Co..... 7
330 So. Los Angeles St., Los Angeles; 345 Oak St., Portland; 807 Mission St., San Francisco.

H-5 Hunt, Mirk & Co.....
141 Second St., San Francisco.

H-7 Hurley Machine Co.....
New York and Chicago.

I-1 Indiana Rubber and Insulated Wire Co..... 12
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L-2 Locke Insulator Manufacturing Co..... 3
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M-4 Morse Chain Co..... 4
Monadnock Bldg., San Francisco.

M-3 Moore & Co., Charles C..... 3
Van Nuys Bldg., Los Angeles; Spalding Bldg., Portland; Kearns Bldg., Salt Lake City; Sheldon Bldg., San Francisco; Mutual Life Bldg., Seattle; Santa Rita Hotel Bldg., Tucson.

N-1 Nason & Co., R. N.....
151 Potrero Ave., San Francisco.

N-2 National Conduit & Cable Co., The.....
Trust and Savings Bldg., Los Angeles; Rialto Bldg., San Francisco.

N-3 National Lamp Works of G. E. Co.....
(All Jobbers.)

N-4 New York Insulated Wire Co.....
629 Howard St., San Francisco.

N-5 Northwestern Pacific Railroad.....
808 Phelan Bldg., San Francisco.

N-6 National Carbon Company.....
Cleveland, Ohio.

O-1 Okonite Co. (The)..... 12
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P-1 Pacific Electric Manufacturing Co.....
80 Tehama St., San Francisco.

P-2 Pacific States Electric Co..... 2
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S-3 Simplex Electric Heating Co..... 12
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S-4 Southern Pacific Co..... 2
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S-5 Sprague Electric Works.....
Rialto Bldg., San Francisco; Colman Bldg., Seattle; Corporation Bldg., Los Angeles; Electric Bldg., Portland; Paulsen Bldg., Spokane.

S-6 Standard Underground Cable Co.....
First National Bank Bldg., San Francisco; Hibernian Bldg., Los Angeles; Yeon Bldg., Portland; Central Bldg., Seattle, Wash.

T-1 Thomas & Co., R.....
(See Western Electric Co.)

T-2 Tubular Woven Fabric Company.....
Pawtucket, R. I.

W-2 Western Electric Co.....
Eighth and Santee Sts., Los Angeles; 1901 Telegraph Ave., Oakland, Cal.; 680 Folsom St., San Francisco; 907 First Ave., Seattle; 45 North Fifth St., Portland, Ore.

W-4 Westinghouse Electric and Manufacturing Co.....
50-52 East Broadway, Butte; Van Nuys Bldg., Los Angeles; Couch Bldg., Portland; 212 So. W. Temple, Salt Lake City; 165 Second St., San Francisco; Second and Cherry Sts., Seattle; Paulsen Bldg., Spokane.

W-5 Westinghouse Machine Co.....
141 Second St., San Francisco.

W-6 Westinghouse Lamp Co..... 6
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W-8 Western Pipe & Steel Co.....
444 Market St., San Francisco; 1758 North Broadway, Los Angeles.

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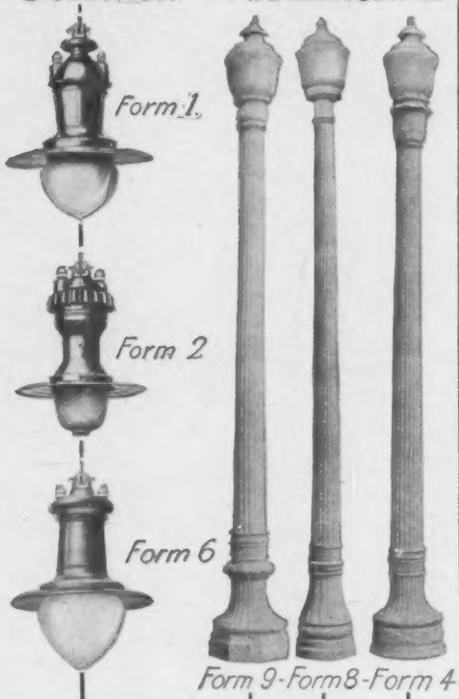

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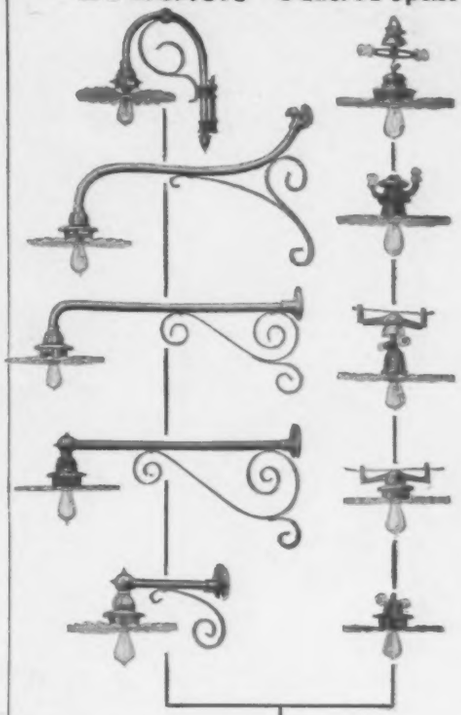

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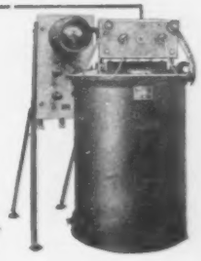
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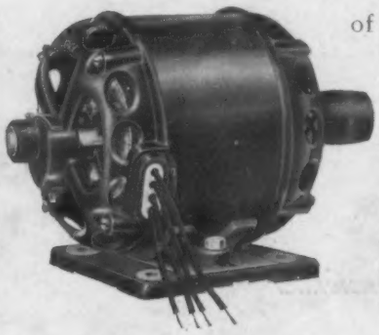

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